April 1983

Chilton's food Engineering

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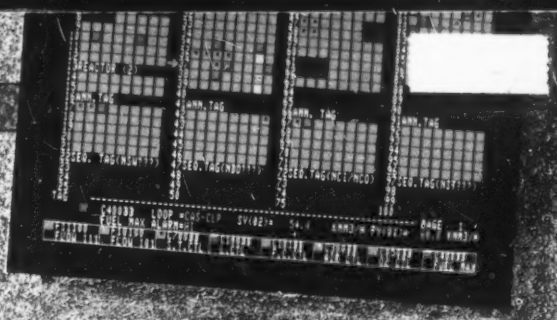
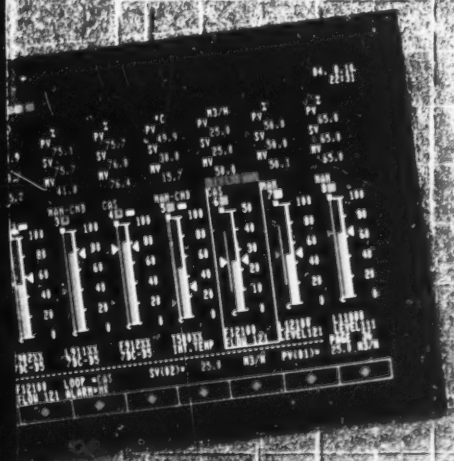
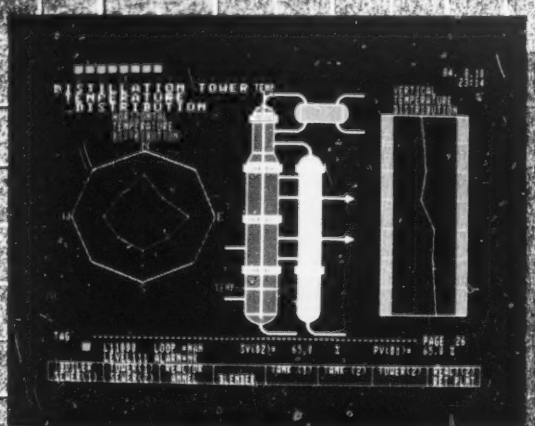
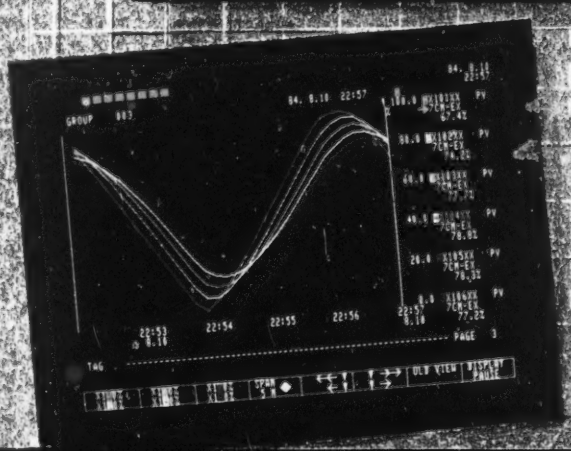
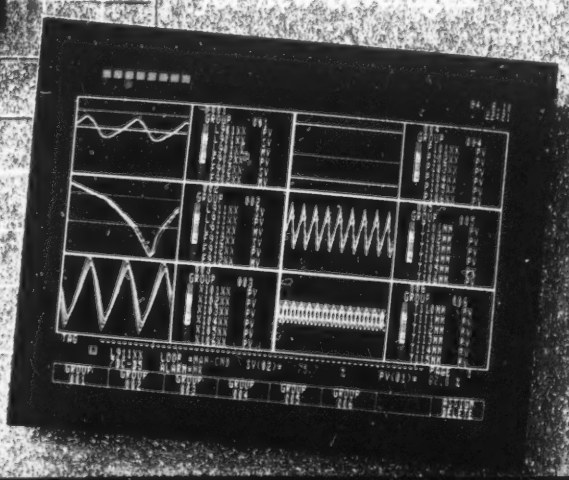




TOMORROW BECOMES TODAY







Chilton's Food Engineering

COVER STORY

Future Tech, Part I takes a look at some innovative technologies and systems to offer new approaches to solve old problems—and the problems of tomorrow. Part II will appear next month. (Color graphics on the cover are courtesy of Yokogawa Corp. of America)

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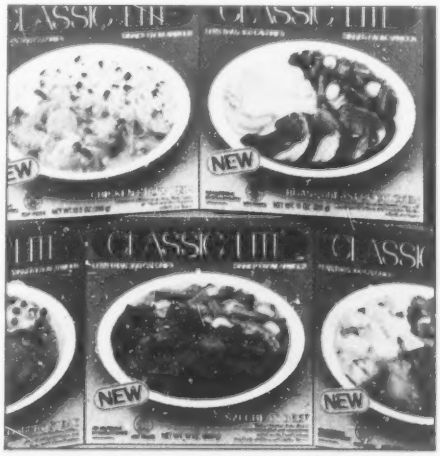
In an exclusive interview, long-time President and CEO of the National Food Processors Association Charles Carey reveals his industry concerns and talks about the status of the association's ongoing projects. Carey also crystallizes the objectives of this predominant food industry association.

19 Coming: a foreign invasion?

The American food industry is ripe for an invasion from Europe and Japan, says Dr. Lester Carl Thurow, professor of economics at MIT's Sloan School of Business Administration.

21 Gerber: no recall

Gerber Products Co. is taking a firm stand in the current tampering crisis. None of its baby food products will be recalled, despite reports of tampering in 35 states.



LOW CALORIE FROZEN ENTREES: The market for premium quality, low calorie frozen entrees continues to grow. Armour has expanded its *Classic Lite* line to satisfy American appetites. **PAGE 23**

Features

45 Future Tech

Faced with the constantly-changing environment in which the food processing industry operates, management faces the continual struggle to adapt and innovate. *Food Engineering* takes a look at some new technologies available to the industry, and some new ways to use old technologies. Part I of a two-part series appears this month, featuring Robotics in the Lab, Computer Integrated Manufacturing, Supercritical Extraction, Flow Injection Analysis, Microwave Processing, Machine Vision, Irradiation, and the Waterknife.

61 Flavors/Part II

Skyrocketing interest in beverages containing fruit juice has caused a flurry of activity in flavor research laboratories. With the popularity of blended fruit juices, wine coolers and soft-drinks containing fruit juices continuing to grow, *Food Engineering* takes you inside the labs to see what is happening now, and what is ahead, in flavors research. The second part of a two-part series, Part I appeared in February.

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Food Packaging

28 FOODPLAS
In his remarks at the conclusion of the recent FOODPLAS conference, Dr. Melvin Druin of Campbell Soup Co. was optimistic about the opportunities for increased use of plastics in packaging. At the same time, however, he recognizes the challenges this use will present.

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Continental Can has manufactured PET containers capable of handling most hot-fill applications. It's a new use of an already-known technology.

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RJRArcher has been able to meet a difficult lidding challenge: make a lid that will give a tight, safe hermetic seal yet still be easy to open for the consumer.

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The Wornick Co. has developed a process to produce shelf stable foods in barrier plastic trays.

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Ocean Spray's new decorative table mold gives a traditional product, cranberry sauce, a new look, with the added plus of shelf stability.

40 Barrier Plastic
As more and more packaging shifts from glass to plastic, *FE* talks to Continental Plastic to find out what is involved in the transition—what to consider, how to handle redesign, how to convert existing bottling lines, etc.

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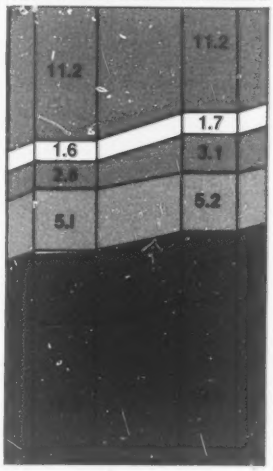
MICROWAVE CUISINE: The Wornick Co. used its expertise in retort pouches to develop a new process to produce shelf stable foods in barrier plastic trays. **PAGE 37**



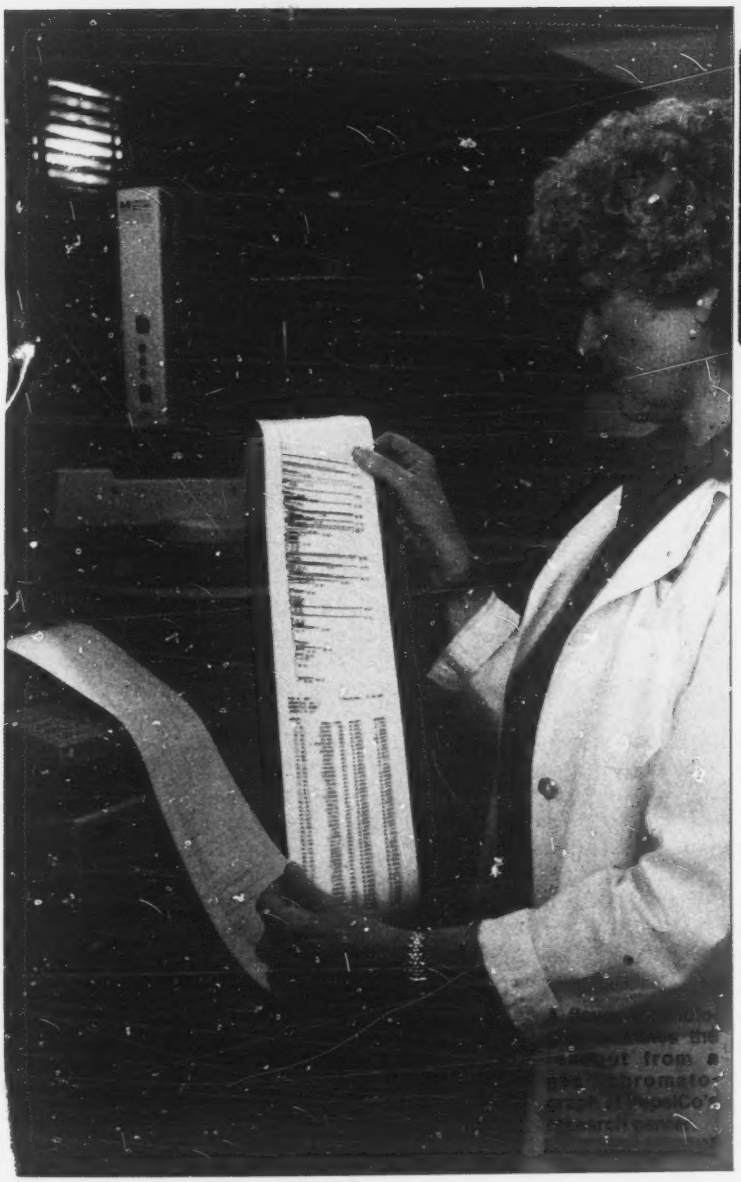
Special Emphasis

FLAVORS/ PART II:
In the second part of this two-part series, we look at the changes and innovations in flavors research brought about by the overwhelming demand for blended fruit juices, wine coolers and soft drinks containing fruit juice. **Pages 61 to 71**

Special Emphasis

FLAVORS/PART II

FLAVORS II: NEW FRUIT FLAVORED BEVERAGES CREATING SPLASH



As the popularity of blended fruit juices, wine coolers, and soft drinks containing fruit juice continue to skyrocket, so has the demand for fruit flavors. In Flavors II, Food Engineering examines how this increased demand for fruit flavor is affecting flavor research by visiting a number of flavor research laboratories.

Fruit flavors are in! That's what Coca-Cola discovered when it introduced *Cherry Coke* last year. Exceeding even Coca-Cola's expectations, Cherry Coke has captured 3-4% of the market and has opened the way for new varieties such as Vanilla Coke, Lemon Coke, or even a Chocolate Coke. All are currently under development.

Research at PepsiCo, Inc. into new fruit-flavored carbonated beverages has also paid off in the marketplace. *Slice*, a carbonated beverage containing 10% fruit juice, commands a 2.5%

ANN E. PRZYBYLA,
Technical Editor

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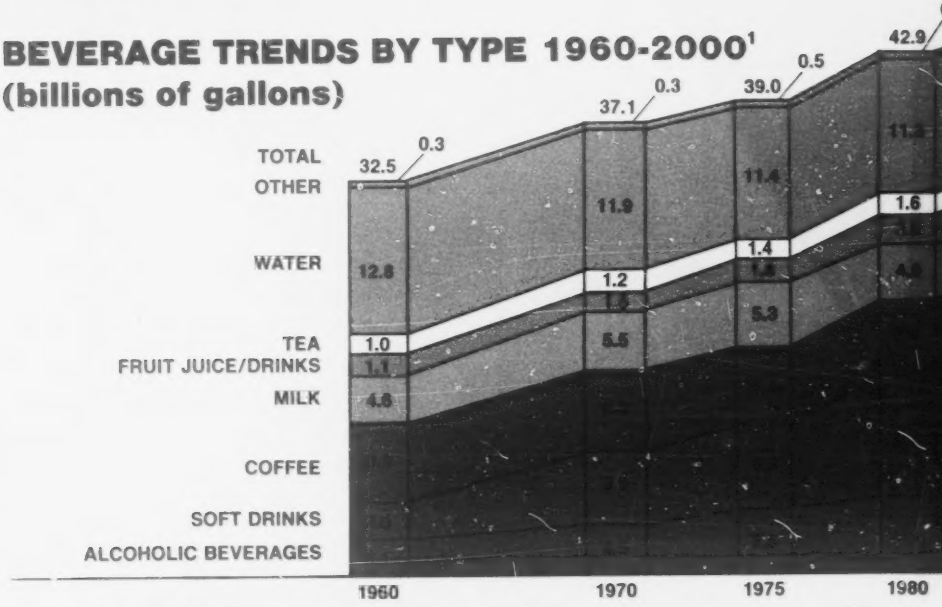


Beverage consumption is increasing in the U.S. Chart courtesy of M. Shanken Communications, Inc., New York, NY.

1 Addition of columns may not agree because of rounding.

Source: IMPACT DATABANK

share of the soft drink market. Lemon/Lime Slice was introduced a little over a year ago and Mandarin Orange Slice was added at the end of 1985. Its rapid acceptance in the marketplace has kept research and development busy creating new varieties. Cherry Cola and Apple are are the newest flavors in the Slice line. They will be available next month. PepsiCo even markets a Mango variety of Slice in Saudia Arabia.

PepsiCo develops all its flavors inhouse at the company's research center in Valhalla, NY. Much of the research is centered around essential oil—a major source of natural flavors. Of the 50,000 tons of essential oils produced worldwide, approximately 14,000 tons are used in the soft drink industry.

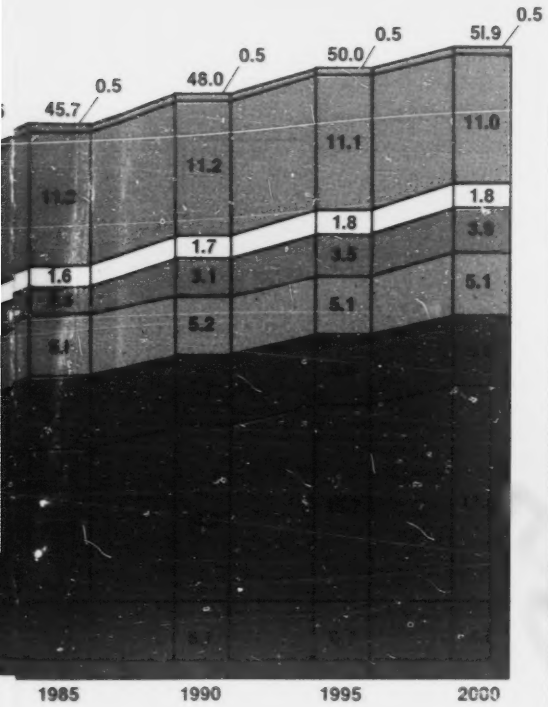
In discussing the flavor development necessary to develop Slice, Johannes A. Buchel, vice president of international research and development for PepsiCo, commented that there is a preference for "natural" flavors because consumers feel that natural tastes better. Diet Slice, for example, contains 1% sugar which comes from the 10% fruit juice since no sugar is added. The natural sugar from the fruit also improves the product's taste, continued Buchel. Lemon/Lime, Mandarin Orange, and Apple Slice contain only natural flavors; while Cherry Cola Slice contains natural and artificial flavors. Apple Slice contains apple juice, and natural apple essence with other natural flavors (WONF).

Flavors fortify juice

Depending on the type of juice, at least 5% juice needs to be in a drink for the juice to significantly contribute to the flavor, points out Jan-Willem Veraar, product manager at Naarden International Flavors, Inc. At the same time, the success of juice-containing beverages have kept numerous flavor suppliers scrambling to develop natural fruit flavors to reinforce the juice's flavor in soft drinks containing fruit juice at low levels. And natural flavors are what the manufacturers are looking for because the actual fruit juice in the soft drink is usually marketed as a health benefit and, therefore, marketing wants an "all natural" product.

Squirt & Company, Holland, Michigan, has developed a patented process for adding flavors lost during processing back to drinks after pasteurization. Due to the heat used in processing, flavors components are lost during the manufacturing of juices and juice drinks. Squirt determined what flavor components were lost and developed a method for combining and adding these flavor components after pasteurization. The company is using this flavor-enhancement process in the manufacture of its *SUNGLO* 100% Orange Juice, Unfrozen Orange Juice Concentrate, 10% Orange Drink, 10% Fruit Punch, and 10% Grape Drink.

Wine coolers are another example of where experimenting with new flavors in beverages has paid off. Wine Cooler consumption jumped from 200,000 gallons in 1982 to 6.6 million gallons just one year later, and is expected to reach 83.5 million gallons by 1993, according to a report by Business Trend Analysts—a Commack, New York-based market research



firm. Here again, flavors are needed to reinforce the flavor of the added fruit juice.

Natural flavor development

Development of fruit flavors begins with the actual fruit—an extract is made and evaluated. This evaluation involves sophisticated analytical techniques such as liquid and/or gas chromatography, mass spectroscopy, head space analysis, infrared analysis, and others. But to meet the demand for natural flavors, it has been necessary to find sources for the flavor other than the original fruit. For example, the cinnamic aldehyde is extracted from the bark of cassia trees found in China and this is further broken down to obtain benzaldehyde—commonly associated with cherry flavor in this country.

A natural fruit flavor may be: totally extracted from the actual fruit; an extract from the fruit with added compounds from other natural sources; or made up completely from other natural sources with natural compounds. If a natural compound is used which does not come from the fruit, then the flavor must be labeled WONF (with other natural flavors). An example would be adding oil tagette (found in marigolds) to an apple concentrate to strengthen the flavor. It would then be called Apple WONF flavor.

Selection of compounds in flavor development is determined, in part, by what type of end flavor is desired and the system it will be used in. For example, a strawberry flavor could require a jammy "note" or perhaps a green "note." Standard citrus flavors have become quite sophisticated—they may now be juicier, pulpier, or peelier, points out Thomas J. Ulinski, director of flavor development for Florasynth, Inc. He gave two reasons for this: consumers' tastes are becoming more sophisticated, which creates additional demand; and more ingredients are available, enabling the development of more specific flavors.

Most new aromatic chemicals used in developing natural fruit flavors such as ketones and esters are coming from biotechnology. Short term research in biotechnology involves new fermentation techniques, while long-term biotechnological research is concerned with tissue cultures which may bypass plants altogether.

Flavors are often used in fruit juice-containing beverages to fortify the fruit flavor. Photo courtesy of Naarden International.

"Biotechnology has brought about methodology to replace synthetic, organic chemicals which have traditionally been used as flavor building blocks," comments James F. Reynolds, director of marketing for the flavor division of Haarmann & Reimer Corporation.

Shortages create demand

The heart of the flavor business is standarized flavors because nature is not standard, points out Robert R. Galluzzi of Flavor Resources. In fact, it is shortages of natural products from crops affected by disease or weather conditions that often dictate the direction of flavor research, he continues. When there was a shortage of passion fruit from Hawaii, requests for passion fruit increased. Or, freezing weather in Florida, which reduces the citrus crop, can increase requests for orange or lemon flavor.

Concurrently, the taste of Americans is broadening, and hence, they are more willing to experiment with new flavors. This trend has impacted on fruit-flavored beverages by creating a demand for the exotic. Kalimansi, kiwi, mango, and passion fruit flavors are becoming more popular. And since, as mentioned earlier, fruit flavor development begins with analyzing the actual fruit, samples of these fruits must first be obtained.

(Continued on page 64)

Passion Fruit Juice Drink

Syrup formulation

Water	25.63 ml.
Sodium Benzoate Solution 25%	.78 ml.
High Fructose Corn Sweetener no. 55	60.81 ml.
Citric Acid Solution 50%	.78 ml.
Passion Fruit Flavor 7P-12789	12.00 ml.
Finished Syrup	100.00 ml.

Additional data

Ratio Syrup to Water:	1 plus 5 equals 6
Carbonation:	3 volumes of gas
Brix:	11.5
Flavor Declaration:	W.O.N.F.
Juice Content:	10.0%

The above sample formulation for passion fruit drink was provided by Naarden International.

This is not easy, however. Fresh fruits cannot be imported to this country. So, because tropical fruits are not grown here, they must be imported in another form. Unfortunately, processing them using heat destroys certain volatile flavor compounds. McCormick has overcome this problem by making distillates of tropical fruit at its essential oil operation in Singapore. The essence is then shipped to the U.S. in a frozen form. McCormick can then analyze both the fruit essence and the canned product to determine the effect that heat used in canning the product had on the fruit's flavor.

Test flavor in end product

Flavor suppliers stress that the ideal situation in developing a flavor for a particular product is to have a sample of that product to test the flavor in, and to know the processing conditions that it will undergo. This is because the system that a flavor is used in has a significant effect on the final "taste" of the product. When a flavor supplier is able to test its flavors in actual products, minor adjustments can be made before the flavor is sent to the customer. This will better assure hitting the target end product.

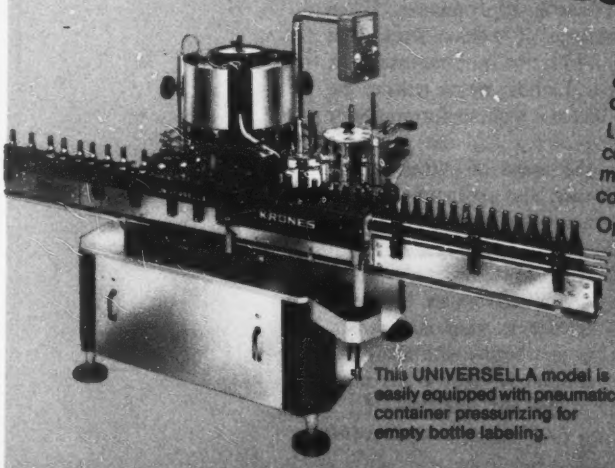
For example, when a flavor is used in a system containing aspartame, certain precautions need to be taken in developing the flavor since some compounds such as aldehydes will break down in the presences of aspartame, points out Saul Riess of Globe Extracts Company. Also, chemicals that won't react with a particular sweetener may only be effective in a certain pH range. So, the fine tuning of a flavor in, say, a beverage may involve suggesting a slight change in pH or carbonation level.

The amount of heat that a flavor is subjected to during processing will also affect the final flavor of the foods it is used in. The selection of a carrier for a flavor system is also influenced by the heat it will eventually be subjected to. For example, alcohol would not be a good choice as a carrier for a flavor which will undergo extensive heat treatment, while propylene glycol could be used since it is much more heat stable. In other words, the more a flavor supplier knows about a final system, the better able it is to develop a flavor that will work effectively in that system—especially on the first try.

Naarden has worked on developing flavors that withstand the effect of UHT processing which subjects a beverage or other product to temperatures as high as 140 to 150° C. The company has more than 30 years experience in this area since UHT processing has been used in Europe much longer than in this country, and

(Continued on page 69)

"Lightweighting" plastic containers may translate into dollars. But that's hardly good news for labeling. Unless...



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FLAVORS/PART II

Naarden's basic research is done in Holland.

In UHT processing, flavor components from both the added flavor and from the product are lost. This is especially true with the UHT process for direct sterilization by steam injection. By removing the injected steam again, volatile parts of the flavors used are also removed. Research in this area has involved discovering raw flavoring materials that better withstand the heat and, in some cases, "rearrange" those flavor components that are most volatile.

Since flavors can be changed during processing, some work is being done to specifically design flavor molecules so that when undergoing normal processing in home preparation such as microwave cooking or baking, the desired chemical component is generated. This work is referred to as precursor technology and is in the area of artificial flavors. Several fruit flavors have been developed in this area.

Heatless flavors

Extracting flavor components without using heat has received considerable attention over the past few years. Supercritical extraction (explained in our cover feature in this issue) is being applied to flavor development work by a number of companies. And McCormick has access to two new technologies for isolating flavors—one of which does not involve heat. Through an advanced separation technique, noncitrus flavors and color are being isolated from fruit in a highly concentrated form. And advanced distillation technology is being used to recover volatile isolates from citrus products. This process involves some heat under a high vacuum.

Once the flavor and color are separated from the fruit, individual components can be separated using distillation (the distillation process being applied to citrus products may be adapted to these flavors). The decision by McCormick to implement these technologies on a full scale may be based on acquisitions which would give the company access to the raw materials. The ultimate objective would be to develop the quality of artificial flavors with natural components, says Philip J. Capasso, director of marketing for McCormick/Stange's flavor division.

Dry mix flavors

Sales of dry beverage mixes increased 20 to 25% with the introduction of aspartame. While dry mix drinks aimed at children—especially flavors associated with red color—have been popular for a long time, a number of new dry mix drinks aimed at adults were introduced once aspartame was approved. These beverages

(Continued on page 71)

Haarman & Reimer Corporation has extensive flavor research and application laboratories in West Germany.

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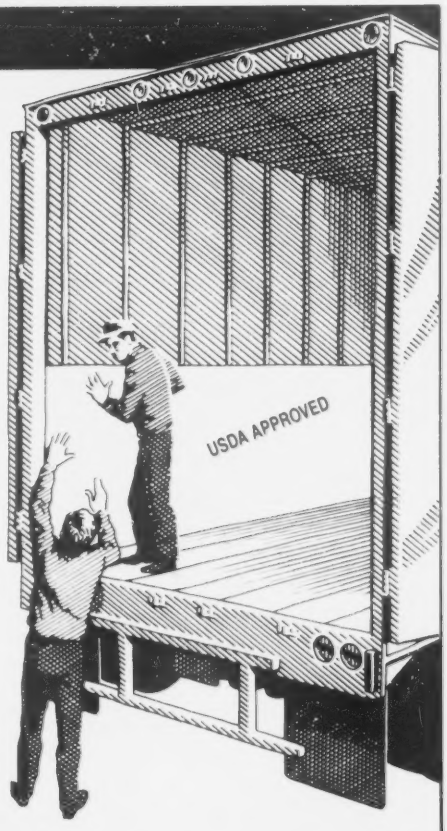

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require a different flavor profile than those aimed at children—ones that taste more like actual fruits.

Flavors for these products obviously need to be in a dry form. Spray drying or a dry emulsion with flavor droplets distributed in a matrix is commonly used to produce flavors in these situations. Also used is encapsulation which generally produces larger particles and a greater surface-to-volume ratio than spray drying. This is done by altering drying parameters such as inflow rate, amount of solids in the feed, and nozzle size.

Encapsulation enables oil soluble flavors to be readily dissolved in water-based drinks. Encapsulation materials may include modified starches, hydrolyzed starches, natural gums, maltodextrin, or a combination. This material should be bland in flavor and inert. It also is desirable to have as little oil on the droplet's surface as possible since the oil on the droplet is not as well protected and, therefore, shelf life is reduced. Oil comes to the droplet's surface as water is evaporated.

Borden produces a line of encapsulated flavors, Borden *Caps*, which are used in most of the Wyler dry mix drinks among other products. Since some of the volatile top notes are lost during the encapsulation process due to the heat involved, the amount of these top notes is increased in the original emulsion, points out Anand Subramaniam, project leader at the Grocery and Specialty Products Division of Borden, Inc.

Artificial and natural

Although "natural" is a key to marketing many of today's foods and hence the rise in demand for natural flavors, "natural and artificial" flavors are also receiving attention. Successful products that were on the market before the onslaught of natural products will remain there. Food processors don't want to tamper with success by changing the flavoring system. For one thing, the cost of natural flavors is causing some manufacturers to reevaluate whether or not a new product needs to be flavored only by natural flavors. Several flavor suppliers commented that while a few years ago many requests were for natural flavors only, today they are receiving more where the processor is willing to look at artificial and natural flavors.

New products are a vital to healthy market growth. And, the highly competitive beverages segment is no exception. For example, more variety is a key to soft drinks' increase in market share. And, fruit flavors are playing an important part in the increased popularity of many of these drinks.

Line of flavors have been specifically developed for wine coolers. Photo courtesy of Ottens Flavors.

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